DIRECT TESTIMONY OF JOSEPH P. RIOLO
ON BEHALF OF RHYTHMS LINKS, INC. AND
COVAD COMMUNICATIONS COMPANY
DOCKET NO. 00-0393 Rhythms

00-0393
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10-19-00

I. INTRODUCTION

1. Q. Mr. Riolo, please state your name, title and business address.

A. My name is Joseph P. Riolo. I am an independent telecommunications consultant. My business address is 102 Roosevelt Drive, East Norwich, N.Y. 11732.

2. Q. Please describe your education and relevant work experience.

A. My education, relevant work experience and qualifications are detailed in my curriculum vita, attached as Rhythms/Covad Exhibit 2.1.

3. Q. What is the purpose of your testimony?

A. I have been asked to address some of the technical issues related to line sharing and loop "conditioning" in this proceeding. I also provide technical support for cost witness Terry L. Murray, and relevant factual information for the Commission to consider.

4. Q. Please provide an overview of the technical issues you will address in your testimony.

A. My testimony begins by defining the term line sharing and describes the technical components of the telephone network required for line sharing. I then address the options that competitive local exchange carriers ("CLECs") must have available to provide xDSL for customers on a line-shared loop. Next, I describe those unbundled network elements ("UNEs") that incumbent local exchange carriers

("ILECs") need to provide to CLECs for line sharing, and the provisioning intervals for key elements such as the shared loop, splitters and tie cables. I will then explain in detail why non-recurring "conditioning" charges for xDSL loops are inconsistent with current (let alone forward looking) engineering practice. In addition, I will show that, even if the Commission allows Ameritech - Illinois ("Ameritech-IL")to charge competitors non-recurring rates for loop "conditioning," the proposed costs for those activities are vastly overstated relative to the cost Ameritech-IL would actually incur using efficient outside plant practices. I will then address issues presented by Ameritech-IL witnesses that are misleading at best, particularly as they relate to xDSL services over fiber-fed Digital Loop Carrier systems. Finally, I will address technical questions presented by the Commission, and provide some general observations on the shortcomings of Ameritech-IL's proposed line sharing tariff.

II. SUMMARY OF CONCLUSIONS

5. Q. Please summarize your conclusions and recommendations.

A. My conclusions and recommendations are as follows:

- Line sharing is practical today on loops that have no more than 18,000 feet of copper. Line sharing on loops longer than 18,000 feet requires the use of fiber fed Digital Loop Carrier ("DLC") systems, which makes that issue important in these proceedings. The 18,000 foot copper limitation exists because POTS service provisioned on loops longer than 18,000 feet requires load coils, which would preclude line sharing by xDSL services.

- It is technically feasible to provide line sharing over fiber-fed DLC systems using currently available technologies.
- Removal of repeaters on line shared loops should not be an issue. Current technology repeaters are used for digital services such as T-1 lines and ISDN lines, which will not be involved in line sharing.
- Removal of load coils on line shared loops should not be an issue: they should be removed by the ILEC as a defect on the line. Load coils are only required for copper loops longer than 18,000 feet, and should not be engineered onto loops of less than 18,000 feet. Loops with more than 18,000 feet of copper cannot currently be used for line sharing as indicated previously, and are therefore not at issue. Loaded loops with copper segments of less than 18,000 feet have load coils on them in error, or through plant rearrangements, and should have all load coils removed from all such pairs at the application of the first POTS dialtone customer, at the ILEC's expense. Load coils are considered a defect on a POTS loop with less than 18,000 feet of copper because consumers expect regular 28.8 kbps, 33.3 kbps, or 56 kbps analog modems to work on their dial up lines at advertised speeds. The inappropriate use of load coils on short copper loops allows analog modem speeds of only 21.6 kbps, 24.0 kbps, or 26.4 kbps, rather than operating at their truly capable speeds. Bellcore Technical Memorandum TM-25704 is included as Rhythms/Covad Exhibit 2.2 to this testimony as evidence of the poor modem performance caused by the presence of load coils.

- Excessive bridged tap is an engineering error on any plant built or rearranged in the last 28 years, and should be removed without charge to a CLEC. Bridged tap should never be put back into outside plant – to do so would violate generally accepted outside plant engineering design principles, would be contrary to established industry practice, and would only reinstitute the deleterious effects of the original substandard bridged tap condition.
- It is appropriate and technically feasible for ILECs to provide CLECs with a menu of three central office splitter configurations.
- It is appropriate and technically feasible for ILECs to provide CLECs with a choice of ILEC-owned splitters in increments of either one line or one shelf at a time.
- In the central office, the most efficient technical manner of providing jumpers and tie cables is to place splitters on the MDF. The next most technically efficient configuration is to place splitters near the MDF, such as in a rack mounting across the aisle from the MDF using preconnectorized cables.

III. TECHNICAL DEFINITION OF LINE SHARING

6. Q. Please define the term "line sharing."

A. As used in this proceeding, "line sharing" is the use of a single loop to provide both POTS and certain high-bandwidth xDSL digital transmission capabilities between a customer's premises and the central office. Such sharing is possible because voice traffic occupies a narrow bandwidth in the lower end of the spectrum available of a loop, traditionally accepted in the industry as between 300 and 3400 Hz[1]. For those types of xDSL services that permit line sharing, xDSL traffic occupies the higher end of the spectrum available on a loop, (*i.e.*, above 4000 Hz). Therefore, both low bandwidth POTS and higher bandwidth xDSL can coexist on a single physical loop.

Customers can obtain significant benefits from line sharing arrangements, because all voice and data needs can be met using a single loop to a home or business location. Thus, line sharing reduces the cost and time required to install or activate additional services into homes and businesses. Second, consumers will get a significant price break, if the incumbent carriers properly cost and price those network elements that CLECs need for line sharing. This is true because customers will no longer pay for one physical loop to meet their voice needs, and another separate physical loop to meet their data transmission needs. They need only pay for one single loop to meet both needs. Third, line sharing conserves limited local loop resources. Customers will not require a second loop to provide full-time data service. In addition, CLEC orders will not have to be turned back due to lack of facilities, since an existing POTS circuit can be used for xDSL in addition to basic POTS service. Fourth, assuming that the line sharing network elements are properly priced, CLECs will have access to the same competitive advantages as ILECs by offering to provide xDSL service over an existing ILEC POTS line.

[1] See, for example: Roger L. Freeman, *Fundamentals of Telecommunications*, John Wiley & Sons, 1999, p. 93. *IEEE Standard Dictionary of Electrical and Electronics Terms*, 6th ed., IEEE Std-100-1996, IEEE, New York 1996.

7. Q. Please define the term "xDSL."

A. "DSL" is an acronym for Digital Subscriber Line. "X" is a variable, meant to encompass the various types of Digital Subscriber Line technologies, and is used when referring generally to DSL. Digital Subscriber Line technologies are transmission technologies used on circuits that run between a customer's premises and the central office. Traditionally, DSL technologies have been deployed on loops that are copper end-to-end ("Home Run Copper"). However, with the deployment of new network equipment by ILECs, some types of DSL may be deployed on hybrid loops that are copper from the customer's premises to a mid-point equipment location known as a remote terminal ("RT"), and then via fiber optics from the RT to the central office.

8. Q. Please describe generally the different types of xDSL technologies available.

A. There are a variety of DSL technologies available for use by carriers today. Some of the major categories have subsets characterized by different line coding approaches or amounts of bandwidth. The major categories are Asymmetric Digital Subscriber Line, or ADSL; Rate Adaptive Digital Subscriber Line, or RADSL (a type of ADSL); Symmetric Digital Subscriber Line, or SDSL; High-bit-rate Digital Subscriber Line, or HDSL; Very High Speed Digital Subscriber Line, or VDSL; ISDN Digital Subscriber Line, or IDSL, G.Lite, and Multiple Virtual Lines ("MVL").

9. Q. What types of xDSL can be provided in a line sharing arrangement?

A. Because POTS over a copper loop normally occupies the frequencies between 300 and 3400 Hz, ADSL can be used on the same loop as POTS because both the downstream and upstream data signals, which are transmitted on different frequencies, fall within a range above those frequencies used to transmit voice signals. ADSL was originally developed to support the delivery of entertainment video, or "video dial tone," services over existing copper loops. Such video services required much higher bandwidth in the "downstream" direction (towards the customer premises) than they did in the "upstream" direction (towards the central office), because the video signals being transmitted to the customer's premises required a large amount bandwidth, and the upstream signal was assumed to be a non-video data signal requiring much less bandwidth. Thus, the need for bandwidth was deemed to be asymmetrical; that is, a high bandwidth signal would exist in the downstream direction and a lower bandwidth signal would exist in the upstream direction. ADSL is also useful for Internet access, because such traffic tends to display an asymmetrical pattern similar to video dial tone services. Most Internet traffic flows toward the end user, as graphics-intensive web pages and data files are downloaded. The upstream traffic normally consists of a few keystrokes and occasional uploads of email and data files.

RADSL, a type of ADSL, can also be used in a line sharing arrangement. Just like ADSL, the downstream and upstream data signals are transmitted using separate frequencies, and both data streams use frequencies above the frequencies used to transmit voice signals. Therefore, RADSL can be used on the same loop as POTS service in a line sharing arrangement. As is the case with other types of ADSL, the downstream and upstream data transmission rates are asymmetrical (as an alternative, it is also possible to configure RADSL for symmetrical data transmission rates). RADSL is more flexible than other types of ADSL because it is rate adaptive; that is, the DSL equipment automatically and dynamically adjusts the transmission speed of the circuit to the optimal level achievable on each loop. RADSL can therefore transmit data at a wide range of transmission speeds, depending on the length and condition of the loop in question. G.Lite is a throughput-limited version of ADSL, used on loops with simple filters, rather than splitters, at the subscriber end. G.Lite eliminates the requirement for a splitter installation at the customer premise. It uses the same part of the frequency spectrum as ADSL, and thus can be used in a line sharing arrangement. Additional enhancements and modifications to xDSL will surely continue in this technology-aggressive industry.

10. Q. What types of xDSL cannot currently be used in line sharing arrangements?

A. SDSL, HDSL, VDSL and IDSL are all symmetrical configurations of xDSL. The downstream and upstream data signals are transmitted using a full range of frequencies, including those used to transmit voice signals. As a result, SDSL, HDSL, VDSL and IDSL equipped loops cannot currently line share with analog POTS service. In addition, given that POTS loops with copper pairs longer than 18,000 feet require load coils, and that all xDSL services are precluded from working on loaded loops, no line sharing for any type of xDSL service can take place on loops containing more than 18,000 feet of copper. Such loops would have to be rearranged to reduce the amount of copper to less than 18,000 feet, such as with fiber-fed DLC systems.

11. Q. Is it possible that other types of xDSL or other advanced services will be able to line share in the future?

A. Yes. Therefore, it is important to understand that this list only represents the current types of xDSL that can be deployed in line sharing arrangements today. There is great interest in various types of advanced services such as xDSL among carriers, vendors, and end users because of the promise of higher bandwidths and lower costs for applications such as Internet access and corporate LAN access. To respond to this demand, vendors are working hard to optimize and extend existing DSL technologies, and are developing new DSL and other advanced service technologies. The advanced services world is far from static, and this Commission should ensure that CLECs will be able to deploy emerging xDSL technologies and other advanced service technologies on shared loops with analog POTS. Because xDSL technology is changing rapidly, this Commission should ensure that ILECs cannot artificially restrict the future deployment of xDSL, in line sharing or in any other network configuration.

12. Q. Who should have the burden of proof of establishing what technologies are not suitable for line sharing arrangements?

A. The ILEC should have this burden of proof. CLECs should be allowed to deploy any xDSL or other advanced services technology that complies with industry standards, or is approved by an industry standards body, the Federal Communications Commission ("FCC") or any state commission. Additionally, such technology should be eligible for deployment if it has been (at the time CLEC is seeking deployment) successfully deployed by any carrier in any state.

In order to ensure that ILECs cannot arbitrarily or artificially prevent or restrict a CLEC's ability to deploy new advanced services, an ILEC should bear the burden of proof for demonstrating the basis of any concerns that a particular technology will cause unacceptable degradation of other services. Specifically, the ILEC should be required to prove to the Commission, and obtain an order or other decision concluding, that the deployment of a particular technology will so significantly degrade the performance of other advanced services or traditional voice band services that restrictions should apply.

IV. NETWORK COMPONENTS REQUIRED FOR LINE SHARING

13. Q. What network elements must a CLEC have in order to provide xDSL in a line sharing arrangement?

A. Obviously, a CLEC must have in place all of the equipment it needs to provide xDSL service. In addition, the CLEC will need services, network elements and interconnection components from the ILEC required to place the xDSL signals on the high bandwidth portion of a POTS loop.

14. Q. What is loop "conditioning"?

A. Older plant designs (or transitional expedients to increase capacity, such as a Digital Additional Main Line, "DAML", two-line carrier system) can include elements that impede or preclude broadband services. In the context of this proceeding, "conditioning" refers to modifications to embedded loop plant facilities needed to remove unnecessary equipment or plant arrangements that would impede the transmission of DSL-based services. The notion that ILECs must "condition" lines for DSL-based services is therefore potentially misleading.

The term "conditioning" has traditionally been used in telecommunications to refer to situations in which equipment must be *added* to a circuit to enable that circuit to perform to tighter engineering parameters. In contrast, to make certain loops in its embedded plant DSL-capable, an ILEC must *remove* unnecessary equipment from the circuit, such as load coils or excessive bridged taps. In other words, ILECs must *decondition* these loops by eliminating equipment that might not have violated engineering design practices more than 20 to 30 years ago, but is not acceptable under current network standards for POTS loops. Thus, the "conditioning" that ILECs seek to include as a cost of xDSL loops in this proceeding—removing obsolete loop attachments and transitioning older plant to a more current design standard—is traditionally a part of ongoing plant maintenance and rearrangement. As a standard business practice, the cost for such activities would typically be captured as a component of outside plant recurring and on-going business expense.

Ameritech-IL in this proceeding has primarily used the term "conditioning" to refer specifically to the removal of load coils, repeaters, and excessive bridged tap.

15. Q. What are load coils?

A. Load coils were used on copper POTS lines longer than 18,000 feet to counteract the effect of capacitance that builds up as the length of the loop increases. Although load coils mitigate the effect of capacitance, they severely attenuate frequencies above 3000 Hz, which is detrimental to both DSL loops and analog data modems. Load coils are unnecessary on loops less than 18,000 feet in length.[2]

16. Q. What is bridged tap?

A. Bridged tap exists where one single dial tone can appear at more than one cable pair location. Bridged tap occurs when a cable pair has a three-way splice (from the central office to location #1 to location #2), such that dial tone can appear in two or more different cable pair locations. Visually, you can think of bridged tap occurring at a fork in the loop. One fork continues necessarily to the customer premises to complete the circuit. The second fork extends some distance into the field, but never terminates at a customer premises.

This approach to outside plant design became obsolete when party-line service became largely obsolete. (*See Bellcore Notes on the Networks*, December 1997, at 12-3: "Multiple plant design [use of bridged tapped pairs] was largely replaced by dedicated plant design because of the labor intensity of adding to or changing existing plant and customer demands to convert from multiple-party line to single-party line service.") Common in the days of party line service, bridged taps should have been engineered out of the network since 1972. The high frequency, digital nature of DSL services (like ISDN services) prevent them from operating with more than 2,500 feet of bridged tap.

17. Q. Has Ameritech-IL proposed loop "conditioning" charges in this proceeding?

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[2] See, for example: Bellcore, *Bellcore Notes on the Networks*, December 1997, p. 7-70 and p. 12-4. Bellcore, *Telecommunications Transmission Engineering*, 1990, p. 89. Lucent Technologies, *AT&T Outside Plant Engineering Handbook*, August 1994, p. 5-3. Roger L. Freeman, *Fundamentals of Telecommunications*, John Wiley & Sons, 1999, p. 104. Harry Newton, *Newton's Telecom Dictionary*, 15th ed., 1999, p. 485.

A. Yes. Ameritech-IL has developed costs and proposed charges for removal of these xDSL interferers.

18. Q. Why should existing ILEC networks not require loop "conditioning"?

A. As noted in Rhythms/Covad Exhibit 2.3, *A Brief History of Outside Plant Design*, decades-old industry engineering standards called for the removal of the very types of impediments that Ameritech-IL proposed xDSL loop "conditioning" costs address. As Rhythms/Covad Exhibit 2.3 explains in more detail, with current loop standards such as the Carrier Service Area ("CSA") guidelines that carriers began to implement in the early 1980s[3], outside plant engineering evolved in a manner that makes bridged tap and load coils obsolete and undesirable.

In particular, the CSA concept was initiated in the early 1980s across the local exchange industry to migrate the outside plant cable network to arrangements over which incumbents could better support a wide range of services. This concept, based in part on the even earlier Serving Area Concept ("SAC"), outlined a strategy that divided the central office geography into discrete serving areas for plant deployment. Under CSA design, the incumbent places a remote terminal containing electronics in each serving area. The RT location is chosen to ensure that the incumbent can serve any customer in that entity via a non-loaded copper cable having minimal bridged tap.

All new plant placed since the early 1980s should meet these engineering guidelines. Furthermore, ILECs should have begun "conditioning" their existing plant as a part of ongoing maintenance since that time.

[3] See Bellcore, *Bellcore Notes on the Networks*, December 1997, p. 7-68.

19. Q. Why should "conditioning" have been performed as a part of routine maintenance?

A. Local exchange carriers have performed, and continue to perform, "conditioning" activities, such as deloading loops, routinely as part of maintaining their loop plant. For example, the ILECs are reinforcing routes and doing other work in the outside plant on a daily basis. Whenever a technician had to work on any plant, that technician should have also been assigned to bring that plant into compliance with current engineering standards to the extent possible. ILECs typically reengineer older plant to eliminate DSL inhibitors such as load coils and bridged tap when growth or replacement requires an upgrade to the existing plant in any specific area.

Furthermore, the ILECs have had to perform "conditioning" for their own services. For example, loops that incumbents use to provide ISDN service typically require the same type of "conditioning" as DSL-capable loops. Of course, loops that incumbents use to provide basic POTS service could never operate with T-1 repeaters on them. Therefore, the ILECs' cost to "condition" their networks would already have been included in the ongoing expenses that the incumbents have incurred and charged to ratepayers for maintaining/improving the local network for many years.

20. Q. Has Ameritech-IL in this proceeding sought to recover the cost for load coil removal on loops of less than 18,000 feet?

A. Yes. Ameritech-IL has proposed charges for removing load coils from loops less than 18,000 feet.

21. Q. Would it be appropriate for ILECs to charge CLECs for load coil removal on loops of less than 18,000 feet?

A. No. That would be like having to pay extra to get a new car without a cracked windshield. A new car should come equipped with a new windshield and you should not have to pay more to get a windshield without a crack on your new car. Similarly, competitors should not have to pay more to get an xDSL-capable loop under 18,000 feet that is free of load coils. "Conditioning" is part and parcel of delivering a loop built to current standards, when that loop is shorter than 18,000 feet.

22. Q. Your discussion thus far indicates 18,000 feet as the decision point for whether POTS loops require load coils. Is this an industry standard?

A. Yes. As previously explained, the telecommunication industry has recognized from the inception of load coil design that 18,000 feet is the point at which load coils are considered for POTS loops. I specifically make this point because Ameritech-IL has proposed in their cost studies, a loop length decision point of 17,500 feet. Obviously, this decision point was reached by Ameritech-IL based on business considerations (e.g.,revenue enhancement), not technical reasons, for it certainly does not comport with any industry standard at any point in telecommunications history.

23. Q. What is the engineering significance in Ameritech-IL's offer to condition loops of less than 12,000 feet without charge?

A. For loops of less than 12,000 feet that contain impediments to xDSL transmission such as load coils, excessive bridged tap, and repeaters, Ameritech-IL appears to treat these as engineering design errors (and rightfully so) to be corrected without charge to the CLEC. While this treatment is correct, the same principle should apply to all loops of 18,000 feet or less, thus comporting with industry standards. Load coils and excessive bridged taps on loops less than 18,000 feet are just as wrong as load coils and excessive bridged taps on loops less than 12,000 feet.

24. Q. Have other ILECS agreed not to charge for load coil removal on loops of less than 18,000 feet?

A. Yes. For instance, Verizon's northeastern ILEC operations do not intend to charge for load coil removal from loops of less than 18,000 feet, because copper loops of that length should not have load coils. Verizon would instead remove such obsolete equipment at its own expense. For example, Verizon – New York (previously "BA-NY") states:

> BA-NY will not impose the Load Coil Removal charge if load coils must be removed from loops less than 18,000 feet long, since load coils are generally not required for such loops under the current or past design criteria applied by BA-NY.[4]

This is appropriate treatment for such loops.

25. Q. Has it been long enough to expect that an ILEC's outside plant should conform to the CSA guidelines that you discussed above, which eliminate a need for load coils on a loop of any length?

A. Yes. It has been 20 years since the industry adopted those guidelines for non-loaded outside plant of any length. Twenty years exceeds the service lives

[4] Panel Testimony of Verizon - New York on Costs and Rates for Loop Conditioning and line sharing for DSL-Compatible Loops in New York Case 98-C-1357, February 22, 2000, at 11.

established by most commissions for outside plant categories of aerial, buried, and underground copper cables. Load coils on copper pairs of any length should therefore be treated as a problem condition, and the ILECs should remove those load coils without charging CLECs.

26. Q. Are there other indications that Ameritech-IL' proposed load coil conditioning charges are unreasonable?

A. Yes. The non-recurring charge proposed in Tariff Ill.C.C. No. 20, Part 19, Section 2, Original Sheet No. 34 indicates that a loop of 18,000 feet would incur a charge of ~~$905.82~~ $569.92 per loop (for removal of load coils on loops between 12,000 feet and 17,500 feet) and an incremental additional charge of ~~$301.94~~ $743.85 per loop (for removal of load coils on loops greater than 17,500 feet.). Thus, Ameritech-IL proposes to charge a total ~~$1,207.76~~ $1,313.77 for each xDSL loop requiring the removal of load coils from a loop (which as explained above, is the direct result of Ameritech-IL' own design error). Moreover, Ameritech-IL bill CLECs a total of ~~$60,388.00~~ $65,688.50 over time to de-load a 50 pair binder group, based on its one-coil-at-a-time approach, whereas the entire task of deloading 50 pairs at once could be accomplished in approximately 4.5 hours. Additionally, to propose multiple re-entries into the "load" splice would render the location a major source of customer outage and dissatisfaction as anyone familiar with Outside Plant Construction/ Maintenance is aware.

27. Q. Why is it undesirable to have bridged tap even in a POTS loop?

A. There are several reasons why bridged tap is undesirable in a POTS loop. First, bridged tap results in dial tone appearing on a pair in two different locations.

Whereas normally, any cable damage in the second location should have no effect on an end user's line at the first location, the mere existence of bridged tap puts the line at risk of service outage should damage occur at location number two. Second, having a bridged pair condition adds detrimental capacitance to the line, which adversely impacts high frequencies, makes one cable pair appear to be longer than it needs to be, and adversely affects analog dial-up modems. Third, having a bridged tap connects an antenna-like device on a pair, which may allow increased hum and noise on the line. Fourth, bridged tap causes additional circuit loss so it reduces the strength of the voice signal, which may erode the quality of service.

28. Q. Is Ameritech-IL's categorization of loops into those that are greater than 12,000 feet and less than 18,000 feet, and those that are greater than 18,000 feet appropriate for the removal of excessive bridged tap?

A. No. As previously discussed, there are no industry standards, nor any technical rationale, which would yield 17,500 feet of loop plant as a significant decision point. Moreover, while there does exist a reason for a decision point at 18,000 feet for purposes of loading voice grade circuits, engineering guidelines indicate that excessive bridged tap should not exist for loops of any length.

29. Q. Should bridged tap ever appear in copper feeder plant?

A. No. Bridged tap should not appear in copper feeder plant. The Serving Area Concept ("SAC") guidelines, introduced in 1972, designated that wire center areas were to be divided into discrete geographic serving areas. SAC specified that the distribution network contained in a serving area should be connected to the feeder network at a *single* interconnection point. (known as the Serving Area Interface). Bridged tap in copper feeder plant would exist only if the same cable pair appeared as a feeder resource in *two different* Serving Area Interfaces, making it inconsistent with SAC guidelines. (See Rhythms/Covad Exhibit 2.3 for a more detailed explanation of the SAC guidelines.)

30. Q. Should bridged tap be used in distribution plant?

A. Although a distribution cable may contain many cable pairs, once distribution spans out into smaller side legs (*e.g.*, the cable assigned to run down a specific block), the same cable pair should never appear in two different side legs. You can think of side legs as forks in the road. With bridged tap, one leg leads to a customer premises and the other dead ends at some other location. Distribution cable should always be engineered in 25-pair binder groups, such that no pairs in a particular 25-pair binder group should ever appear in more than one side leg. This ensures no bridged tap conditions between separate distribution side legs. This "binder group integrity" guideline was even a key concept in SAC design standards of 1972 vintage.

31. Q. What bridged tap guidelines are dictated under the CSA guidelines?

A. CSA guidelines state that "[t]he maximum allowable bridged-tap is 2.5 kft, with no single bridged-tap longer than 2.0 kft." (Bellcore, *Bellcore Notes on the Networks*, December 1997, at 12-5.)

32. Q. When is bridged tap removal required to provide xDSL-based services for loops designed under reasonably current engineering guidelines?

A. CSA guidelines permit bridged tap use, but only up to a level that generally does not interfere with xDSL (*i.e.*, the 2,500 feet per total and 2,000 feet per individual bridged tap limits). As I have explained, ILECs would not need to remove bridged tap from plant designed to meet CSA guidelines because the CSA design limits bridged tap to a level that would not interfere with xDSL. Therefore, bridged tap removal is not required for loops that comply with the CSA standards regarding bridged tap. Ameritech-IL plant should now conform to these twenty-year-old industry standards for outside plant construction and maintenance. Excessive bridged tap exists on a loop only if ILECs ignored industry standards and neglected outside plant maintenance. In those instances, ILECs should bear the entire cost of removing such bridged tap. Nonetheless, Ameritech-IL proposes to charge for bridged tap removal.

V. AMERITECH-IL SUBSTANTIALLY INFLATES LOOP "CONDITIONING" COSTS BY FAILING TO INCORPORATE EFFICIENT ENGINEERING PRACTICES IN THEIR COST STUDIES.

33. Q. Do the Ameritech-IL "conditioning" studies reflect efficient current practices?

A. No. As I have already explained in detail, current engineering practices dictate that ILECs should have been removing load coils and excessive bridged tap from their systems over the last 20-30 years. In addition, Ameritech-IL inflates "conditioning" costs by substantially overstating work times and, even more significantly, by understating the number of loops that they should "condition" whenever a technician is dispatched to do that type of work.

34. Q. Should the ILECs "condition" more than one pair at a time?

A. Yes. If the Commission allows any recognition of "conditioning" as a nonrecurring cost, it is most important to the issue of determining a reliable unit cost to recognize that "conditioning" old plant should always be done for multiple lines at once. Even if one assumes that costs should be based on backward-looking, outdated plant designs, it is always efficient to "condition" multiple loops at the same time. Therefore, the cost for such refurbishing of older plant should be spread across all of the loops that benefit from that work. Indeed, in Ameritech-IL's typical operation, such maintenance, upgrade and/or rearrangement work would be booked into a general expense account and not treated as a nonrecurring event. Once a loop has had improper load coils, excessive bridged taps and repeaters removed, that loop can be used over and over again for subsequent POTS users.

In the cost studies presented in this proceeding, Ameritech-IL has proposed a discriminatory separate treatment of "conditioning" costs as nonrecurring when a competitor initiates the request. It is a standard efficient engineering practice to deload and unbridge more than one loop at a time. Indeed, the standard practice in the industry is to prevent multiple re-entries into outside plant splices because multiple re-entries can cause serious deterioration in the wire insulation that will cause telephone wires to short out. Consequently, engineers have been instructed to engineer copper plant in terms of binder groups of either 25 pairs or groups of 50 pairs. (A "binder group" is designated as such because, inside a copper cable sheath, groups of pairs are segregated into manageable groups of pairs by binding such a group of either 25 pairs or 50 pairs with a thin color-coded ribbon wound around that group of pairs.) Standard engineering practice is to attempt to maintain "binder group integrity," that is, to splice and otherwise treat all of the pairs in a given binder group as a unit. Single pair splicing, *i.e.*, splicing only one or a few of the pairs in a given binder group for some purpose, has been avoided for decades.

Moreover, it is simply more efficient to work with facilities a group at a time. If pairs are not "conditioned" in multiples of 25 or 50 pairs, or more, at a time, then a splice will soon degrade. Load Coil Cases are designed in groups of pairs to facilitate "conditioning" an entire binder group or more at a time. Attempting to isolate individual lines results in a tangled "bunch of grapes" look that is more difficult to work with. Therefore, to simplify both current and future operations, it is more efficient to treat the entire group rather than to create and have to deal with a tangled mass of individual wire splices.

35. Q. What would be a reasonable number of pairs to "condition" at one time?

A. For numerous reasons, I recommend that the Commission recognize that "conditioning" will, on average, be done 50 pairs at a time. In addition to the practical reasons that I provided above, such as that "conditioning" entire binder groups will limit maintenance problems associated with multiple splice reentry, "conditioning" an average of 50 lines at a time is a practical actual average.

Considering load coils first, for loops under 18,000 feet in length, it makes no sense whatever from an engineering perspective to dispatch a technician to remove load coils and to remove anything less than all of the coils currently deployed on cables that will serve customers within 18,000 feet of the central office. Load coils are not useful and are harmful to loops under 18,000 feet. They should be removed at the first opportunity. The total number of loops under 18,000 to be deloaded at once would therefore range from a minimum of the 25 pairs on the binder group with the target xDSL loop to potentially *hundreds* of pairs that happen to be loaded in multiple binder groups at the same location (as loading is done at regular intervals,[5] the load coils for various binder groups would be collocated). Even when the splice may include pairs for loops over 18,000 feet, it still makes no sense from an engineering perspective to "condition" one line at a time — particularly given the substantial predicted demand for xDSL services over the next few years. An efficiently managed outside plant operation will always maintain some level of available spare. ILECs should "pre-condition" a reasonable projection of total spare plant to meet anticipated demand for xDSL-based services every time it dispatches a technician and splices are being opened. Therefore, on average, a 25-pair binder group should be unloaded, even when the splice contains pairs for loops longer than 18,000 feet. Combining the over- and under-18,000 feet estimates, 50 pairs per load coil removal dispatch across all loop lengths is a reasonable average.

36. Q. Are there times when only one pair can be "conditioned"?

A. Occasionally. However, as I just explained, there are also cases where many hundreds of pairs at a time can be "conditioned" at once. I propose an approach

[5] Normal load coils are only placed at 3,000 ft., 9,000 ft., and 15,000 ft. (plus any additional increments of 6,000 feet) from the central office.

that will be reasonable for the vast majority of cases. For example, if a load coil must be removed from a 25-pair splice with other working lines that are longer than 18,000 feet of copper, then it would not be proper to deload the entire 25-pair group of pairs. However, there are other cases involving a 2,400-pair cable working at 75% utilization (1,800 working pairs, and 600 spare pairs). With 600 spare pairs, it may make sense to deload several hundred pairs in anticipation of rapid growth for DSL services.

The number of pairs that an ILEC should "condition" will vary based on local conditions, but assuming that the ILEC will "condition" 50 pairs at a time is a reasonable middle ground.

37. Q. Does it make sense to remove bridged tap for one loop at a time?

A. No. As with load coils, "conditioning" 50-pairs at a time is a reasonable average. Loops under 18,000 feet that contain bridged tap are, by definition, relatively short. As a result, the cables over which these loops are provisioned would generally be larger-size cables. It is therefore reasonable to unbridge a minimum of 50 "working" loops in each cable at a branch splice, in each direction.

The benefits of unbridging multiple working pairs that have unnecessary bridged tap are manifold. First, the requested "conditioning" for the service order is accomplished. Second, for example, if 100 pairs at this branch splice location are unbridged (a procedure that improves the existing service without disrupting it), such an activity transitions the network towards present-day engineering standards. (The ILECs should have been unbridging their pairs since the introduction of the Serving Area Concept in 1972.) Third, transmission of voice-grade service on these working circuits is improved because the insertion loss, caused by the bridged tap, is removed. Fourth, the unbridged working circuits provide a base of preconditioned pairs that could be utilized for future services that are incompatible with excessive bridged tap, For example, ILECs could provision loops for those services via a line and station transfer to one of the unbridged working circuits in lieu of opening cable splices to unbridge an individual pair at the time of the future service request. ILECs should provide these line and station transfers at no cost, should the ILECs decide not to unbridge spare pairs. Fifth, the unbridged working services now have less exposure to maintenance problems, which will result in reduced customer trouble reports. Sixth, "conditioning" working service precludes the need to re-enter a working splice on numerous occasions to "condition" one pair at a time, which potentially causes customer outages. Seventh, unbridging working service does not require the amount of engineering study that would be involved if every spare pair were studied, grouped, and allocated to a specific branch cable (this is an expedited method that I have used in the past to effectuate the unbridging of pairs as called for in SAC design). Because the actual "wire work" is a relatively minor portion of the cost of the job, this methodology is cost efficient.

Moreover, unbridging multiple pairs at a time substantially reduces the "conditioning" cost on a "per unit" basis. The benefit to ILECs is that the CLEC order would trigger an unbridging opportunity to clean up its outside plant inventory — something that it should have been doing proactively since SAC design in 1972, but perhaps had no opportunity to do so because the particular bridged tap splice involved had no activity in the last 28 years.

For loops longer than 18,000 feet that traverse an unbridging splice, it must be understood that bridged tap cannot exist except by engineering error. Engineering guidelines do not permit bridged tap between load coil sections; therefore, bridged taps should only be located in the customer end section of cable plant, *i.e.*, within 3 to 12 Kft of the customer location (correctly loaded loops must have a minimum of 3 kft. to a maximum of 12 kft. of copper cable between the last load coil in the loop and the customer premises.).[6] Even for these longer, loaded loops, the ILECs could still achieve benefits similar to those described for non-loaded loops by unbridging multiple pairs. However, the number of working lines to be unbridged at a branch splice location would likely be smaller, *e.g.*, 25 working pairs per cable (a total of 50 pairs), to account for the diminished size of the cables.

38. Q. Do Ameritech-IL studies reflect the guidelines you suggest?

A. No. Ameritech-IL has maintained that it will remove load coils from only one pair at a time.

39. Q. Does Ameritech-IL's proposal regarding removal of load coils make sense?

A. No. For copper facilities under 18,000 feet in length, load coils are not needed to provide basic voice or any other common service. The presence of load coils on such facilities generally indicates either that the plant in question was once used to

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6 See Bellcore, Bellcore Notes on the Network, December 1997, p. 7-70.

serve customers farther from the central office and has been rearranged, or that the facilities in question were engineered in error. Because the continued presence of load coils for loops shorter than 18,000 feet does nothing other than inhibit services on those facilities, the load coils in question should have been removed as a part of regular maintenance. If Ameritech-IL did not take advantage of related dispatches to remove those coils in the past, it makes no sense at all not to remove *all* of the load coils present once a technician is dispatched to remove any coils. Removing all the coils present makes sense because it requires almost no incremental effort to remove multiple coils. Indeed, it is more efficient to remove all of the coils on a cable than to attempt to remove some small subset thereof.

Given that it is efficient to remove all of the coils in a route for facilities under 18,000 feet, it is probable that the total number of loops that an efficient carrier would deload at one time would include multiple 25-pair binder groups and, therefore, would be substantially more than 50 per dispatch. And, as I have already explained, for copper facilities over 18,000 feet in length, traversing the same splice, it makes sense to "condition" a portion of the available spare that corresponds to the demand for advanced services that is likely to evolve over the long run on that route.

40. Q. What is Ameritech-IL's position regarding the appropriate number of pairs from which bridged tap should be removed at one time?

A. Ameritech-IL's proposals call for the removal of bridged taps one pair at a time. As I explained in detail above, it makes no sense not to remove bridged tap from multiple loops once a technician has been dispatched.

41. Q. How should "conditioning" 50 pairs at once affect a cost calculation for "conditioning"?

A. Because ILECs should condition an average of 50 pairs per "conditioning" dispatch, the cost per pair would be 1/50th of the cost per "conditioning" dispatch. This effort has been in the past, and should continue to be in the future, an ongoing cost of maintaining the outside plant inventory in a serviceable manner, as part of outside plant recurring charges.

VI. IF THE COMMISSION INAPPROPRIATELY ADOPTS ANY NONRECURRING COST FOR "CONDITIONING," SUCH CHARGES SHOULD REFLECT EFFICIENT METHODS, PROCEDURES AND TOOLS.

~~**42. Q. If the Commission were to award Ameritech-IL the right to charge for "conditioning," could it rely on the Ameritech-IL proposals?**~~

~~A. No. For all the reasons I have detailed in the foregoing sections, the Ameritech-IL "conditioning" studies are too flawed to rely upon. The range of proposals by the ILECs makes that apparent. For example, the ILEC proposals for removing load coils range form a low of $5.74 for Sprint to remove an aerial coil to a high of $ 1,448.22 for GTE (now Verizon) to remove any coils generically.~~

43. Q. If the Commission were to award Ameritech-IL the right to charge for load coil removal , what tasks and task time assumptions would be appropriate?

A. If the Commission elects to permit Ameritech-IL to impose such charges — which it should not — then such charges should be based on engineering practices generally employed in the telecommunications industry and on reasonably efficient task time estimates.

Load coils were deployed, starting only when a copper loop reaches 18,000 feet in length, at 6,000-foot intervals, starting with three locations (at 3,000 feet, 9,000 feet, and at 15,000 feet). Also, because feeder cable is normally placed in conduit when close to the central office, I conservatively assume that the first two load coil locations involve underground cable at manhole locations. The third location is most likely in aerial or buried locations. Therefore, I have assumed that deloading of the third load coil location will be at an aerial location 50 percent of the time, and deloading of the third load coil location will be at a buried location 50 percent of the time. The Commission can use the following work steps and conservative time estimates to estimate the costs involved in removing load coils from these three locations:

Underground Cable Load Coil Removal in a Manhole		
Step	Description	Task (min.)
1	Travel time to underground splice location.	20
2	Set up work area protection and underground work site.	5
3	Pump and ventilate manhole.	15
4	Buffer cable / Rerack cable / set up splice.	5
5	Open splice case.	5
6	Identify pairs to be deloaded for 1st 25-pair binder group.	5
7	Bridge 25-pair binder group for service continuity (if necessary).	5
8	Remove / sever connection from main cable to load 'in' & 'out taps.	3
9	Rejoin / splice 25-pair binder group through main cable.	5
10	Remove bridging modules from Step 7.	2
11	Identify pairs to be deloaded for 2nd 25-pair binder group.	5
12	Bridge 25-pair binder group for service continuity (if necessary).	5
13	Remove / sever connection from main cable to load 'in' & 'out' taps.	3
14	Rejoin / splice 25-pair binder group through main cable.	5
15	Remove bridging modules from Step 12.	2
16	Clean, reseal, and close splice case.	10
17	Rack cables, pressure test cables in manhole.	10
18	Close down manhole, stow tools, break down work area protection.	10
	Total Minutes	120
	Total Hours	2.00
	No. Technicians	2
	Total Timesheet Hours	4.00
	No. Locations	2
	Total Hours	8
	Pairs deloaded	50
	Minutes per pair	9.6 min.

Aerial Cable Load Coil Removal at a Pole (50% occurrence)		
Step	Description	Task (min.)
1	Travel time to aerial splice location from underground splice location.	10
2	Set up work area protection.	5
3	Set up ladder or bucket truck.	10
4	Open splice case.	5
5	Identify PIC pairs to be deloaded for 1st 25-pair binder group.	2
6	Bridge 25-pair binder group for service continuity (if necessary).	5
7	Remove / sever connection from main cable to load 'in' & 'out taps.	3
8	*Rejoin / splice 25-pair binder group through main cable.*	5
9	Remove bridging modules from Step 6.	2
10	Identify pairs to be deloaded for 2nd 25-pair binder group.	2
11	Bridge 25-pair binder group for service continuity (if necessary).	5
12	Remove / sever connection from main cable to load 'in' & 'out taps.	3
13	Rejoin / splice 25-pair binder group through main cable.	5
14	Remove bridging modules from Step 11.	2
15	Clean, reseal, and close splice case.	10
16	Secure splice case to strand and clean up work area.	10
17	Close down aerial site, stow tools, break down work area protection.	10
	Total Minutes	94
	Total Hours	1.57
	No. Technicians	1
	Total Timesheet Hours	1.57
	No. Locations	0.5
	Total Hours	0.78
	Pairs deloaded	50
	Minutes per pair	0.94 min.

Buried Cable Load Coil Removal at a Pedestal (50% occurrence)		
Step	Description	Task (min.)
1	Travel time to buried splice location from underground splice location.	10
2	Set up traffic cone at rear bumper of truck.	1
3	Walk to site & open splice pedestal.	2
5	Identify PIC pairs to be deloaded for 1st 25-pair binder group.	2
6	Bridge 25-pair binder group for service continuity (if necessary).	5
7	Remove / sever connection from main cable to load 'in' & 'out taps.	3
8	Rejoin / splice 25-pair binder group through main cable.	5
9	Remove bridging modules from Step 6.	2
10	Identify pairs to be deloaded for 2nd 25-pair binder group.	2
11	Bridge 25-pair binder group for service continuity (if necessary).	5
12	Remove / sever connection from main cable to load 'in' & 'out taps.	3
13	Rejoin / splice 25-pair binder group through main cable.	5
14	Remove bridging modules from Step 11.	2
16	Secure splice within buried pedestal and clean up work area.	3
17	Close down buried site, stow tools and traffic cone.	5
	Total Minutes	55
	Total Hours	0.92
	No. Technicians	1
	Total Timesheet Hours	0.92
	No. Locations	0.5
	Total Hours	0.46
	Pairs deloaded	50
	Minutes per pair	0.55 min.

44. Q. If the Commission were to allow Ameritech-IL to charge for load coil removal, what charges would be appropriate?

A. The Commission should use work steps and time estimates I have listed, along with the labor rates it adopts for Ameritech-IL, to estimate the costs involved in removing load coils. I have estimated that the total average time for removing all load coils from a loop is just over 11 minutes per pair. For example, at a labor rate of $45, a load coil removal charge of $8.32 per pair would apply.

45. Q. If the Commission were to award Ameritech-IL the right to charge for bridged tap removal, what tasks and task time assumptions would be appropriate?

A. Again, if the Commission elects to permit Ameritech-IL to impose such charges — which it should not — then such charges should be based on reasonably efficient practices generally employed in the telecommunications industry.

As I explained previously, the ILECs should have eliminated bridged taps almost 30 years ago, except for limited end-section bridged taps that could be removed in the service terminal at time of an installation visit. In addition, bridged tap should not exist in underground feeder cable close to the central office. Therefore, I would assume that a single case of bridged tap, if it occurs, would occur 50 percent of the time at an aerial location, and 50 percent of the time at a buried location. Accordingly, the Commission can use the following work steps and conservative time estimates to estimate the costs involved:

Aerial Cable Bridged Tap Removal at a Pole (50% occurrence)		
Step	Description	Task (min.)
1	Travel time to aerial splice location.	20
2	Set up work area protection.	5
3	Set up ladder or bucket truck.	10
4	Open splice case.	5
5	Identify PIC pairs for bridged tap removal for 1st 25-pair binder group.	2
6	Remove bridging modules or cut & clear pairs for 1st 25-pair group.	2
7	Identify PIC pairs for bridged tap removal for 2nd 25-pair binder group.	2
8	Remove bridging modules or cut & clear pairs for 2nd 25-pair group.	2
9	Clean, reseal, and close splice case.	10
10	Secure splice case to strand and clean up work area.	10
11	Close down aerial site, stow tools, break down work area protection.	10
	Total Minutes	78
	Total Hours	1.30
	No. Technicians	1
	Total Timesheet Hours	1.30
	No. Locations	0.5
	Total Hours	0.65
	Pairs Unbridged	50
	Minutes per pair	0.78 min

Buried Cable Bridged Tap Removal at a Pedestal (50% occurrence)		
Step	Description	Task (min.)
1	Travel time to buried splice location	20
2	Set up traffic cone at rear bumper of truck	1
3	Walk to site & open splice pedestal	2
4	Identify PIC pairs for bridged tap removal for 1st 25-pair binder group	2
5	Remove bridging modules or cut & clear pairs for 1st 25-pair group	2
6	Identify PIC pairs for bridged tap removal for 2nd 25-pair binder group	2
7	Remove bridging modules or cut & clear pairs for 2nd 25-pair group	2
8	Secure splice within buried pedestal and clean up work area	3
9	Close down buried site, stow tools and traffic cone	5
	Total Minutes	39
	Total Hours	0.65
	No. Technicians	1
	Total Timesheet Hours	0.65
	No. Locations	0.5
	Total Hours	0.33
	Pairs Unbridged	50
	Minutes per pair	0.40 min.

46. Q. If the Commission were to award Ameritech-IL the right to charge for bridged tap removal, what charges would be appropriate?

A. Again, the Commission should use work steps and time estimates I have listed, along with the labor rates it adopts for Ameritech-IL, to estimate the costs involved in removing bridged tap. I have estimated that the total average time for removing a bridged tap from a loop is under two minutes per pair. For example, at a labor rate of $45, a bridged tap removal charge of $0.89 would apply.

47. Q. Has Ameritech-IL proposed conditioning charges in connection with removal of repeaters?

A. Yes. While the removal of repeater charge is explicitly detailed in the proposed tariff, there does not appear to be any definition of the type of repeater to be removed, other than it may exist on loops of any length.

On rare occasions, voice grade repeaters serve the function of extending the range of non-loaded and loaded wire pairs. Prior to the advent of digital loop carrier in the 1970's, very long copper loops utilized this technology to extend the range of the loop (e.g.,up to 35 miles or 185 Kft of 22-gauge H88 cable). This technology, for the aforementioned purposes, is antiquated (1950's) technology.

Another potential type of repeater found on copper loops are those required for the provisioning of T-1 services. These digital repeaters were generally spaced less than 32dB apart during the provisioning process. Should ILECs be suggesting that the CLECs pay for the removal of these repeaters, it would be highly inappropriate from several points of view. First, it should be part of the original circuit disconnect charge and not be passed on to the next user of the loop. Second, these repeaters are relatively costly and should be recovered as per standard PICS process. Third, when retired from service, a "cut-thru" plug can be inserted into the apparatus case to permit the reuse of the cable pair while the repeater is re-inventoried for redeployment. Thus, it is obvious that removal of repeaters is a routine function of service disconnect or plant modernization and charging the CLEC is totally inappropriate, especially since one of these repeaters could never exist on a working POTS loop. Where (these unusual) repeaters are present, they should be removed from a loop and the spare loop should be returned to outside plant inventory to be available for POTS service.

48. Q. What else must ILECs make available for CLECs to provide xDSL service?

A. ILECs must also make available technical characteristics of the loop. It is important to note that CLECs must be able to access loop makeup information contained in the databases of Ameritech-IL. Without access to technical information about the loop, CLECs cannot determine what, if any, of the various versions of xDSL service can be expected to function on a given loop. Therefore, CLECs would be unable to determine if the ILEC-supplied loop is capable of delivering the level of service performance they would guarantee customers using any particular xDSL service.

49. Q. **Please explain the general line sharing transmission path.**

A. As explained in Exhibits 2.4 through 2.7, attached to this testimony, there are two different network configurations for line sharing. It is important to note that Ameritech-IL and other ILECs have acknowledged that they intend to provide line sharing over both of these configurations.

The first, which I call "Home Run Copper," consists of voice and data carried simultaneously on an all copper loop from a customer's premises to the Main Distribution Frame ("MDF") in the ILEC's serving wire center. Rhythms/Covad Exhibits 2.4 through 2.6 each show a copper distribution pair that runs from the customer premises to the field side of the ILEC's serving area interface ("SAI"), where it is connected to a copper feeder pair on the central office side of the SAI. This copper feeder pair terminates in an appearance on the loop side of the MDF, located in the ILEC's serving wire center. From the MDF, that loop is then connected via a tie cable to a splitter, where the low bandwidth (for POTS) and the high bandwidth (for data) are separated.

As I explain below, the three different home-run copper arrangements pictured in Rhythms/Covad Exhibits 2.4 through 2.6 reflect three different possible locations for the central office splitter used to provide line sharing over home run copper loops: (a) via a tie cable to the CLEC collocation arrangement, where it connects with splitter/Digital Subscriber Line Access Multiplexer ("DSLAM") equipment that the CLEC owns (see Exhibit 2.4); (b) via a tie cable to a common splitter location available to all CLECs (see Exhibit 2.5); or (c) via a splitter at the distribution frame (or another incumbent controlled area in the central office near the MDF (see Exhibit 2.6).

A second configuration, which I call "Fiber-Fed DLC," consists of voice and data carried simultaneously on a copper loop from a customer's premises to a Remote Terminal, and then carried on fiber from the Remote Terminal to the central office, and on to a CLEC's designated point of interconnection. Rhythms/Covad Exhibit 2.7 illustrates this second network configuration.

50. Q. What network components and equipment are required for the "home run copper" configuration?

A. CLECs need access to the high bandwidth portion of an all-copper loop that runs from the demarcation point at the customer premises to the ILEC's serving wire center. At the serving wire center, the CLEC must be able to access a splitter to separate the data signal from the voice signal and route the data signal to its collocated DSLAM.

51. Q. What are the possible locations for splitter placement in a serving wire center?

A. There are three possible locations for the splitter in a wire center. The CLEC can purchase and own a splitter located in the CLEC's collocation arrangement (depicted in Exhibit 2.4). In this scenario, both the POTS and data traffic will arrive at the CLEC collocation arrangement via a tie cable obtained from the ILEC. At the collocation arrangement, the tie cable will terminate at the splitter, which will separate the POTS analog voice traffic and the high bandwidth data traffic. The data CLEC retains the high bandwidth data traffic and routes it to its terminating destination via a transport UNE from the wire center. The voice traffic is handed off to the voice provider via a tie cable provided by the ILEC.

Another option is for the CLEC to locate the splitter in an area of the serving wire center outside of the CLEC's collocation arrangement but on an equipment rack in a common area of the central office (depicted in Exhibit 2.5). In this scenario, a CLEC would receive the data traffic from the high bandwidth portion of the loop via a tie cable, which runs from the MDF to the splitter and then from the splitter to the CLEC's collocation arrangement. The tie cable from the MDF to the splitter, the tie cable required to obtain the voice traffic from the splitter, and the tie cable required to obtain the data traffic from the splitter should be provided by the ILEC. In addition, the splitter may be purchased and owned by either the CLEC or the ILEC. If the ILEC owns the splitter, the CLEC should be able to designate the vendor from whom the ILEC purchases the splitter. Also, if the ILEC owns the splitter, the CLEC should be able to obtain the splitter functionality on an individual "port-at-a-time" basis. In either case, the CLEC should also have full access rights to the splitter, and the right to perform isolation testing.

Finally, as depicted in Exhibit 2.6, the splitter can be located directly on the Main Distribution Frame. As with the previous arrangement, the CLEC should be allowed to choose whether to purchase and own the splitter itself, or to have the ILEC purchase the splitter (either from a third party vendor acceptable to the CLEC or from the CLEC). If the ILEC owns the splitter, the CLEC should be able to obtain the splitter functionality on an individual "port-at-a-time" or on a bundled "shelf-at-a-time" basis, depending on the CLEC's preference, and the ILEC should be responsible for all maintenance and repair work. However, the CLEC must also be provided test access to the splitter as required to provide and insure the quality of its xDSL service. With this arrangement the CLEC would pick up high bandwidth data traffic from the loop via a tie cable obtained from the ILEC. The tie cable runs from the splitter at the MDF to the CLEC's collocation arrangement. As with the second option, the ILEC will provide the tie cable required to obtain data traffic from the splitter. The most efficient forward looking network design calls for the placement of splitters on the horizontal side of the MDF.

52. Q. What is the most efficient method of designing, installing, and connecting splitters?

A. The last option I described, placing the splitter directly on the ILEC's distribution frame, is the most efficient method to provide line sharing over home run copper loops. To maximize efficiency with this arrangement a CLEC should be able to order traditional tie cables from the ILEC distribution frame to the CLEC's collocation arrangement to be terminated directly onto the frame mounted splitters. With pre-connection to the data side of splitters at the MDF and to a CLEC's collocated DSLAM via a tie cable, line sharing would then be accomplished by placing two MDF cross connection pairs (*i.e.*, jumpers). The first jumper connection would run from the splitter to the vertical outside plant side of the MDF taking the entire spectrum of the loop to the splitter. The second jumper would run from the splitter to the horizontal switch side of the MDF with the end user's voice grade service signal.[7] This arrangement is shown below as *Figure 1*.

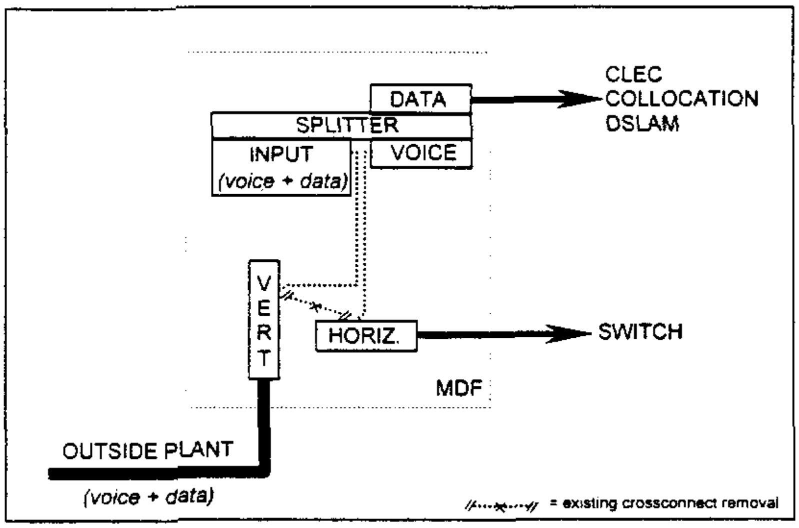

Figure 1

53. Q. Should costs and prices be based on the MDF-mounted splitter method?

A. Yes. Ms. Murray explains in her testimony why costs and prices should be based on this most efficient MDF-mounted splitter method. The ILEC may prefer other arrangements or might seek to impose terms and conditions (such as limiting access to the splitter in some locations) that require CLECs to accept other

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[7] There should be no recurring charges for this jumper, since it duplicates the functionality of the ILEC's original jumper used for its own POTS service.

arrangements. Regardless of what arrangements the ILEC is ultimately willing to allow, line sharing costs and prices should be based on the most efficient method. If a determination is made that an MDF-mounted splitter method cannot be implemented, then the CLEC should have the option of designating what alternative should be deployed, while pricing is retained at a level that meets the most efficient standard.

54. Q. Do you agree with the Ameritech-IL cost studies on the installed costs for splitters and tie cables?

A. No. As Ms. Murray explains, Ameritech-IL has indicated a need for two sections of 100 pair cable, each 200 feet long. All details are missing regarding justification of these unusually long lengths of cable, and the unshielded cable would not be necessary in an efficient MDF-mounted splitter arrangement. In addition Ameritech-IL indicates one Siecor 89 Type 100 pair termination block and one Lucent 112 Type 100 pair termination block for each cable, which would indicate a terminal block at each end.

The splitter mounting has Amphenol cable connectors (similar to a personal computer printer cable connection) that allow plugging preconnectorized tie cables directly into the splitter shelf without a separate terminating block. This obviates the need for one of the terminal blocks. Therefore, I conclude only one of the termination blocks would be needed, rather than four. In addition, a 200 foot cable length is excessive for the average collocation arrangement, and certainly two such lengths of cable are excessive even if the splitter is located away from the MDF.

Ameritech-IL includes in-place cost factors that are unreasonable for all of its investment calculations pertaining to splitters and tie cables. These unreasonable factors account for the cost of installing material, and can readily be converted to hours and examined against reasonableness and expert opinion. The following analysis demonstrates such unreasonable costs, even if the items installed were necessary, which I believe they are not.

*****BEGIN AMERITECH-IL PROPRIETARY*****

[8] For example, in its USF proceedings, the FCC determined that punch down pair terminations (a similar function to that required to terminate tie cable pairs in a central office) could be performed at the rate of 200 pairs per hour [see FCC 96-45 FNPRM dated 5/8/99, Appendix D2].

END AMERITECH-IL PROPRIETARY

55. Q. Does it make sense to use an in-place cost factor for this new equipment?

A. No. The existing In Place Cost Factors were derived by Ameritech-IL by dividing embedded equipment material and installation costs by the embedded cost of the material. Splitters have almost no cost to install. Therefore, if such an historical factor were to be used (which has captured all existing costs), the In Place Cost of all circuit equipment would have to be reduced accordingly. Otherwise, over-recovery results from using a factor that is too high.

56. Q. Based on your experience, do multiple tie cables to several intermediate distribution frames ("IDFs") involving many cross connections for one circuit cause maintenance and reliability problems?

A. Yes. Ameritech-IL claims that almost all of their central offices are so congested that IDFs are necessary. In my extensive experience, the extensive use of IDFs only happened in Manhattan, with typical central offices terminating 200,000 pairs or more. Several special task force investigations continued to identify multiple IDFs, and especially multiple cross connections, as a major cause for poor circuit quality and service disruptions. I would personally direct any engineers under my supervision to avoid the use of Intermediate Distribution Frames and multiple cross connections if at all possible. The purpose would be to improve quality service, make the provisioning process faster and simpler, and to reduce cost (in that order of priority). The use of seven cross connection points as Ameritech-IL proposes is unconscionable, in my opinion as a technical expert interested in service quality. Every cross connect is a likely point of failure for the circuit.

57. Q. Are Ameritech-IL's proposed cross connection charges for new service reasonable?

A. No. Ameritech-IL has provided times that are unreasonable and functions that are unnecessary. The initial work step is "Login and Completeness Check." This is an appropriate work step; it involves simply picking up work for the day, and it is communicated electronically to the appropriate technician. I believe that our proposal to allow 2.5 minutes for this work effort is reasonable. However, as indicated in its response to Covad Data Request No. 26 (see Rhythms/Covad Exhibit 2.9). Ameritech-IL costs this task at

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58. Q. Are Ameritech-IL's proposed cross connection charges for a disconnect reasonable?

A. No. First, charges for disconnects should not be charged at the time of installation, as Ms. Murray explains. Next, Ameritech-IL apparently assume that the DSL service will *always* be disconnected before the underlying basic exchange service. It thereby includes costs to restore the voice service, which will in all likelihood often (or even typically) be disconnected at the same time. In addition, Ameritech-IL has provided times that are unreasonable and functions that are unnecessary, just as it did for new service connections as stated previously. In fact, although a disconnect takes a very short amount of time to unwrap a termination, pull out a cross connection pair, wind it around one's hand, and throw it in a trash receptacle, Ameritech-IL proposes unreasonable times that are identical to service initiation with

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All of these times are unreasonably long, and should be denied.

59. Q. Must CLECs have physical access to the splitter, irrespective of the location arrangement?

A. Yes. The quality assurance given by the CLECs to their customer base for xDSL services requires that CLECs have physical access to the splitter regardless of its location. Moreover, this access must be 24 hours per day, 7 days per week, and not requiring an ILEC employee escort. This access is primarily required to perform trouble isolation work: for example, to determine whether a problem is in the ILEC's portion of the circuit, the CLEC's portion of the circuit, or even, in the case of a shelf-mounted splitter (which is less efficient than an MDF-mounted splitter), to discover whether a splitter card has been inadvertently removed, thereby putting the entire circuit out of service.

60. Q. Which of these components are provided by the ILEC and which are provided by the CLEC?

A. ILECs must provide the high bandwidth portion of the loop as an unbundled network element. ILECs provide tie cables under their existing collocation arrangements. The ILEC must also provide jumpers between tie pair appearances in non-collocation space. CLECs should have the option of self-provisioning the splitter, purchasing the splitter and providing it to the ILEC for installation and maintenance, or using an ILEC-purchased, owned and maintained splitter.

61. Q. Should Ameritech-IL's tariff include a line sharing UNE provisioning interval similar to that decided in the Rhythms/Covad arbitration?

A. Yes. The provisioning interval for the line sharing UNE should be significantly shorter than the intervals applicable to standard xDSL-capable loops because Ameritech-IL already has provisioned the loop used for the line sharing UNE to the customer premises. The only physical work required for the provisioning of a line shared loop is wiring the splitter into the existing service, which involves removing one cross-connect and replacing it with two new cross connects. This process should easily be accomplished in less than 10 minutes. No additional time or work is necessary. Line sharing does not require any work to be performed outside of the central office and the existing customer telephone number and cable pair are reused.

62. Q. What are appropriate intervals for Ameritech IL to provision line shared loops?

A. Because line sharing will occur on loops that are already operational, and have existing POTS service, Ameritech IL should be able to provision a line shared loop much more quickly than a typical loop. Ameritech IL already knows that the loop is available and operational, therefore less testing and physical provisioning should be necessary. However, the provisioning interval will reasonably vary depending on the network configuration through which the line shared loop is provided and whether de-conditioning is required.

Rhythms and Covad proposed during their line sharing arbitration a phased-in approach whereby Ameritech IL must provision loops on increasingly shorter intervals as their expertise grows. Under that proposal, from June 6 to September 6, Ameritech IL would have three business days to provision line shared loops not requiring conditioning and five business days for loops that require de-conditioning; from September 6 to December 7, two business days for loops not requiring conditioning and four business days for loops requiring conditioning; and after December 7, 24 hours for loops not requiring conditioning and three days for loops requiring conditioning. The intervals also include cooperative acceptance testing and any line and station transfer necessary for provision of xDSL service.

63. Q. What interval does Ameritech IL propose in its tariff?

A. Ameritech IL is proposing a five-day interval for provisioning a line-shared loop.

64. Q. Has any state commission ordered an ILEC to provision line shared loops according to the scheduled proposed by Rhythms and Covad?

A. Yes. Earlier this month, this Commission ordered Ameritech IL to provision line shared loops, including those requiring conditioning, according to the schedule proposed by Rhythms and Covad in their line sharing arbitration. The Commission should allow all CLECs to have this same interval by incorporating the results of the Rhythms/Covad Arbitration Award setting provisioning intervals.

65. Q. Should the provisioning process include testing?

A. Yes. Loops often have problems that make them unusable when turned over by Ameritech IL. Loop acceptance testing performed on the due date provides a CLEC an opportunity to test and verify that a loop is actually working *on the due date*. However, a large percentage of the loops provisioned do not test to specifications on the due date, causing Rhythms to miss commitments to it end-user customers. To eliminate this problem Ameritech IL should include a "plant test date" as part of the provisioning process. This same concept of testing a circuit prior to due date is utilized by Ameritech IL for its POTS, Resale, and

Design service retail circuits. Other SBC operating companies already provide pre-due date testing to CLECs for xDSL UNE loops prior to loop turnover. Loop acceptance testing prior to turnover is critically important, because if there is a problem with the loop, the CLEC can reject it, and Ameritech IL then can resolve the problem. Just as important, the CLEC has an opportunity to notify its customer in advance that there may be a delay in providing DSL service. CLECs must have an acceptance testing process available to them in order to compete equally with Ameritech IL for provision of DSL services

66. Q. How should the acceptance testing process work?

A. Once Ameritech IL completes such testing and obtains passing results, Ameritech IL should inform the CLEC that it believes the installation has been properly performed. Then the CLEC can either accept the loop as is, or should be able to conduct its own test. If the CLEC conducts its own testing and the results demonstrate that the line shared loop is capable of being used to provide advanced services, the CLEC should accept the loop. If the CLEC test reveals a problem that interferes with the CLEC's ability to provide advanced services on the loop, the CLEC should have the option of refusing to accept the line, and may instead open a trouble ticket. Such trouble ticket should not be placed in the general population of maintenance and repair trouble tickets, but rather should receive expedited treatment as an installation problem. Until Ameritech IL cures the problem with the loop, or until Ameritech IL and the CLEC collectively agree that the problem lies with the CLEC's equipment or facilities, including any customer premises equipment, the installation should be deemed to be incomplete and failed.

67. Q. What should acceptance testing include?

A. The testing that Ameritech IL provides will differ depending on the network configuration through which line sharing is provided. If the line sharing arrangement is provided through the home-run copper configuration discussed in this Testimony, Ameritech IL should test the line shared loop for copper continuity and for pair balance prior to completing the installation. If the line sharing arrangement is provided through the fiber-fed DLC configuration, Ameritech IL should test all fiber between the port on the optical concentration device ("OCD")[9] and the Ameritech IL Remote Terminal, and should test the copper portion of the loop connecting the Remote Terminal to the end-user customer premises for copper continuity and for pair balance prior to completing the installation.

Ameritech IL should notify the CLEC that a loop will be ready for turnover at least one day in advance. The CLEC should be able to conduct acceptance testing on the loop any time during that period. If Ameritech IL provides greater notice to its own retail or outside affiliate, then CLECs should get the same amount of notice.

68. Q. What type of maintenance is required by CLECs for line sharing equipment?

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9 Under SBC's proposed configuration for Project Pronto, incoming data traffic from the Remote Terminal will terminate at an ATM switch, referred to as an "Optical Concentration Device" ("OCD"). The OCD aggregates many incoming OC-3cs from multiple remote terminals to a smaller number of outbound OC-3 or DS3 facilities. Additionally, the OCD routes packetized data traffic to the CLEC's own, or other ATM network, based upon packet routing addresses.

A. As described in this Testimony, CLECs should have the option of owning line sharing equipment (i.e., the splitter) themselves, or of obtaining such equipment from Ameritech IL. In general, therefore, Ameritech IL should be responsible for all testing, repair and maintenance of facilities and equipment on its side of the splitter and the CLEC should be responsible for all testing, repair and maintenance of facilities and equipment on its side of the splitter. In addition, the CLEC should have physical and remote test access to the test head twenty-four hours a day, seven days a week regardless of whether the test head is located in the serving wire center or the Remote Terminal.

Because the splitter separates data and voice traffic being carried simultaneously on a loop, any problems with the splitter can cause difficulties for both the voice provider (Ameritech IL or CLEC) and the data provider (Ameritech IL or CLEC). Therefore, both Ameritech IL and CLECs should agree to coordinate in good faith any splitter testing, repair and maintenance that will significantly impact the service provided by the other party. In no event should Ameritech IL perform any splitter testing, repair or maintenance that interrupts the flow of data to a CLEC customer without first coordinating with CLEC to reach a mutually agreeable time for the necessary testing, repair or maintenance work to occur. Such notice should be given no more than two hours in advance notice for any repair effort needed to restore service to an Ameritech IL end-user that has suffered a complete loss of voice services.

69. Q. How quickly should ILECs provide tie cabling required for line sharing?

A. ILECs should complete the installation and provisioning of any tie cable ordered by CLECs within thirty calendar days of receipt of a request from a CLEC. This expedited timeframe should apply regardless of whether a CLEC has its equipment collocated in a cage or elsewhere in an ILEC's serving wire center.

70. Q. Are there any technical reasons why ILECs cannot provision tie cables in thirty days for line sharing arrangements?

A. No. Some ILECs may claim that they cannot meet the thirty day installation interval, but there is strong reason to believe that they can. Although complex installations in wire centers may be routinely scheduled to take more than thirty days, such installations cover a wide range of equipment of varying complexities, configurations, and testing requirements. For example, installation of complex power equipment in a wire center will take much longer than installation of a tie cable. Thus, ILECs often commit to installation intervals lengthy enough to cover any type of installation, no matter how complex.

Installation of tie cables however, is a simple task that ILECs routinely perform. Because the FCC's Line Sharing Order required that line sharing be available by a date certain, ILECs should have been, and should be planning to proactively install numbers of tie cables, and as discussed below, splitters, necessary for line sharing on an expedited basis and in bulk. Installation of multiple tie cables can be done efficiently and quickly at any particular serving wire center, making the thirty-day installation interval quite achievable.

71. Q. Why do CLECs want the option of purchasing and owning the splitter?

A. Some CLECs may prefer to have the ILEC own the splitter. However, CLECs need unobstructed access to the splitter, need splitters that best support their service offerings, and some CLECs wish to control ownership of the splitter to allow future flexibility, thereby making CLEC ownership of the splitter very important.

Access is vital because CLECs guarantee service quality and reliability levels for advanced services such as xDSL. It would be very difficult for CLECs to live up to those guarantees if they were not able to own, control and maintain equipment. This problem would be especially acute if ILECs were allowed to own the splitter, but not required to purchase the splitter from the CLEC's vendor of choice. Equipment from different vendors has differing levels of quality, features, and reliability.

There are other reasons why CLECs may want to own the splitter. In the short term, CLECs can help ensure that splitters needed to support line sharing arrangements are deployed as rapidly as possible. If ILECs exclusively control the purchase and ownership of splitters, but are not able to obtain and/or deploy enough splitters to meet CLEC demand, there will be nothing CLECs can do. CLECs will be prevented from exercising their right to access line sharing arrangements in a timely manner, but will be unable to take action by purchasing their own splitters and deploying them in their collocation arrangements.

In the long term, allowing CLECs to own splitters will ensure that new leading edge technologies are deployed as rapidly as possible to serve customers with new capabilities. ILECs are less likely to stay at the leading edge of technology deployment because they invest in very large volumes of equipment from one vendor. There will be many CLECs seeking collocation for the purpose of providing xDSL services, and they should have the option of owning the splitter.

72. Q. How quickly should the ILEC provide the splitter for CLEC line sharing?

A. As with the tie cables discussed below, ILECs should begin immediately to install splitters for use by CLECs in line sharing arrangements. ILECs should complete the installation and provisioning of any splitter on an expedited basis, and complete installation within thirty calendar days of receipt of an order from a CLEC. This expedited timeframe should apply regardless of whether the splitter is located in the CLEC common area in the ILEC's space. As discussed below, ILECs should be installing splitters and tie cables in bulk at wire centers. The splitter installation, like tie cables, is a simple installation, and is quite achievable in thirty days.

73. Q. Why should ILECs be required to provide a menu of splitter location options?

A. First, Covad and Rhythms are not the only CLECs that will purchase line sharing arrangements from ILECs. Therefore, for example, if ILECs are permitted to prohibit CLEC access to a frame-mounted splitter or cannot provision sufficient frame-mounted splitters in a timely manner, the CLEC should be granted the flexibility to locate splitters in a different manner than in its own collocation arrangement. Such flexibility is very important to CLECs. The FCC has determined that line sharing is critical for CLECs to compete effectively with

ILECs who have the ability to "line share" their POTS and data services now. Therefore, in response to any concession to ILECs that precludes full CLEC access to sufficient numbers of frame-mounted splitters, the CLEC should be able to choose either of the other two options for any given wire center in order to ensure CLECs have the widest range of choices. CLECs may need such options to address all of their needs, to adapt to a variety of space constraints and configurations, and to care for the varying abilities of ILECs to meet deadlines for deployment of facilities needed for line sharing.

74. Q. Will Ameritech Illinois's deployment of a "fiber-fed DLC" architecture have an impact on CLECs' abilities to engage in line sharing?

A. Yes. Based on current engineering standards, ILECs will be continuing to deploy a greater percentage of fiber-fed loops in the future. Indeed, some ILECs, such as Ameritech-IL, have announced a very aggressive rollout of this configuration. Other ILECs expect to deploy this configuration over the next several years, supplanting the home run copper architecture in areas where fiber-fed DLCs are deployed. ILECs have advanced various arguments in support of their position that the FCC's line sharing mandate does not apply to the fiber-fed DLC architecture.

Based on my understanding of the FCC's line sharing order, I believe the FCC wanted CLECs to have access to line sharing arrangements for every loop, not just those served by home run copper. Otherwise, ILEC fiber based plant modernization programs would prevent CLECs from competing. There are a number of critical issues that must be addressed to allow CLECs to engage in line sharing for fiber-fed DLC loops.

75. Q. What line sharing options are technically feasible in a fiber-fed environment?

A. For fiber-fed loops, the technically feasible line sharing options depend on whether the incumbent's DLC equipment is DSL-compatible. Forward-looking DLC equipment incorporates the DSLAM/splitter function into line cards that are placed in the DLC. Ameritech-IL is in the process of installing such DLC equipment as part of SBC's Project Pronto. SBC's public announcements concerning Project Pronto indicate that the company plans to upgrade, supplement or replace the majority of its DLC equipment over the next three years. Older generations of DLC equipment may not support DSL-based services, but instead may require either the substitution of an available copper feeder facility or the collocation of a separate DSLAM/splitter at the RT where the incumbent's DLC equipment resides. Alternatively, carriers can physically or virtually collocate their own DSLAM functionality at the incumbent's RT.

Rhythms/Covad Exhibit 2.7 illustrates the network architecture associated with these approaches to line sharing for fiber-fed loops. As shown on Exhibit 2.7, a copper distribution pair runs from the customer premises to the field side of the incumbent's SAI, where it is connected to a copper feeder pair on the central office side of the SAI. In a forward-looking configuration with DSL-compatible DLCs, this copper feeder pair will terminate on a line card with integrated DSLAM/splitter functionality that plugs into one of the channel banks in the DLC equipment located in the incumbent's RT. In an embedded configuration with non-DSL-compatible DLCs, the incumbent's copper feeder pair would have to be cross-connected to a DSLAM/splitter collocated at the RT. In cases where space at the RT is too confined, this arrangement might be facilitated and achieved more efficiently by placing and wiring the DSLAM/splitter normally located in the RT to the SAI. The incumbents' RTs can be located in Controlled Environmental Vaults ("CEVs"), huts and cabinets.

In both configurations, the Asynchronous Transmission Mode ("ATM") bitstream carrying ADSL can be combined with other traffic in the incumbent's SONET equipment at the RT, and carried on the same fiber(s). Fiber feeder facilities run between the SONET equipment at the RT and SONET equipment at the incumbent's serving central office. At the central-office-based SONET equipment, there are a number of possible connections. For the ATM-based bitstream carrying ADSL, the requesting carrier can take a handoff at an ATM switch in the serving central office,[10] or can take a handoff at an ATM edge switch located outside the serving central office.

In a fiber-fed loop scenario with DSL-compatible DLC, the primary unbundled network element that requesting carriers must acquire from the incumbent to offer DSL-based services is a 2-wire DSL-capable loop that comprises the incumbent's copper facilities from the NID at the customer premises to the customer side of the RT, the electronics at the RT necessary to derive the required bandwidth over the incumbent's fiber feeder facilities, and transport over the incumbent's fiber feeder from the RT to the serving central

10 SBC is using the terminology Optical Concentration Device ("OCD") to describe this central-office-located ATM switch.

office. A carrier leasing a 2-wire DSL-capable loop to provide ADSL-based services may take a handoff at either the serving central office or at a centralized ATM "edge" switch. Given current technical limitations relative to routing traffic to multiple destinations from the RT, if the requesting carrier takes the handoff at the serving central office, the carrier will need to obtain at least one port on something like the ATM switches/OCDs that Ameritech-IL would deploy as part of Project Pronto. (This port allows the requesting carrier to take its concentrated data traffic on a DS-3 or OC-3; thus, a single ATM switch/OCD port should suffice under most plausible assumptions concerning ADSL "take" rates for an individual serving central office.) If the requesting carrier takes the handoff at the centralized ATM "edge" switch, the extended DSL-capable loop also includes shared transport from the serving central office to the location of the ATM "edge" switch. The requesting carrier will also need to acquire at least one port on the ATM "edge" switch.

At the requesting carrier's option, the fiber-fed loop may also include an incumbent-owned line card in the DLC equipment at the RT. This line card will perform the DSLAM/splitter functions. The requesting carrier may also choose to self-supply the required line card and have the incumbent install the card at the RT. The self-supply option is an important protection against overstated, outdated pricing of line cards. Line cards for DSL applications are just beginning to become commercially available. Current prices almost certainly overstate the long-run cost of these cards. Self-supply also allows requesting carriers to have access to a greater variety of DSL line cards than the incumbent may choose to stock, which will lead to more service options for end-users.

76. Q. What unbundled network element options should the commission require Ameritech-IL to offer given the technically feasible possibilities for line sharing over fiber-fed loops?

A. To reflect the various opportunities for unbundling of fiber-fed DSL-capable loops, the Commission should require Ameritech-IL to offer unbundled network elements that reflect two alternative scenarios for ownership of the line card that provides the DSLAM/splitter functionality: (1) the incumbent owns the card, and (2) the requesting carrier supplies the line card. The Commission should also require the incumbent to offer unbundled network elements that reflect two alternative scenarios for the point at which they handoff the DSL data stream to the requesting carrier: (1) the incumbent's final data switching point via an ATM switch/OCD at the serving central office, and (2) the incumbent's final data switching point via a centralized "edge" switch. In the latter scenario, the requesting carrier's traffic may "transit" a central-office-based ATM switch/OCD. Thus, in addition to purchasing the relevant DSL-capable loop element, the requesting carrier would also need to purchase an element that combines "transit" of the incumbent's ATM switch/OCD with shared interoffice transport.

The Commission should also require Ameritech-IL to offer multiple options for the transport of the requesting carrier's data signals over the incumbent's fiber feeder facilities: (1) permanent virtual circuits ("PVCs"); (2) permanent virtual paths ("PVPs") and (3) time-division-multiplexed ("TDM") circuits.[11] Requesting carriers should have the option of obtaining PVCs and PVPs in any of the possible formats, including ITU-T Quality of Service Classes A, B, C, and D; ATM Forum Quality of Service Classes 1, 2, 3, and 4; and Service Class Categories Available Bit Rate, Constant Bit Rate, Variable Bit Rate – real time, Variable Bit Rate – not real time, and Unspecified Bit Rate.

Finally, the Commission should require Ameritech-IL to offer both physical and virtual collocation at the RT location wherever feasible.

77. Q. Are there any other network elements required for CLECs to provide line sharing?

A. Yes. Under all three of the scenarios described above, the CLEC must have access to Interoffice Transport, which is provided by the ILEC as a UNE. The CLEC needs such Interoffice Transport UNEs to transport its high bandwidth data traffic between its collocation arrangement in the serving wire center and its point-of-presence, node, or collocation arrangement in a different wire center. CLECs will need access to a variety of Interoffice Transport bandwidths (*e.g.*, DS0, DS1, DS3, or OCn).

VII. TECHNICAL INPUT ASSUMPTIONS UNDERPINNING COVAD'S AND RHYTHMS' PROPOSED COSTS AND PRICES.

78. Q. Have you included documentation regarding high bandwidth services line sharing non-recurring cost analysis?

11 The last option will apply in a line sharing mode only when line sharing extends to types of DSL other than ADSL variants.

A. Yes. I have included a High Bandwidth Services Line Sharing Non-Recurring Cost Analysis description as Rhythms/Covad Exhibit 2.10. This documentation provides information regarding general assumptions, calculations, analysis operations, conclusions, and technical information regarding common tasks, nonrecurring cost element descriptions, and information regarding placing and removing jumpers, ILEC and CLEC owned DSL line cards at the Remote Terminal, configuration of PVCs within a PVP, ATM Edge Switch/OCD ports, and fiber cross connections at the Fiber Distribution Frame.

79. Q. Have you reviewed the cost support for the prices that Covad and Rhythms are proposing in this arbitration?

A. Yes, I have.

80. Q. To the extent that the cost support cites to engineering subject matter expert opinion for inputs such as the tasks, task times and occurrence factors in the nonrecurring cost analysis, do you support the input assumptions on which Covad's and Rhythms' proposed prices are based?

A. Yes, I do. I worked closely with Ms. Murray to provide, review and comment upon all engineering input assumptions underlying Covad's and Rhythms' proposed prices for line sharing. Based on my experience with telecommunications engineering practices, I believe that the engineering-related input values represent reasonable values that an efficient incumbent local exchange carrier can achieve.

VIII. MISLEADING STATEMENTS BY AMERITECH-IL WITNESSES

81. Q. Have you reviewed the direct testimony of Ameritech-IL witnesses in this proceeding?

A. Yes. I would like to add additional clarification regarding statements made by witnesses Jacobson, Schlackman and Lube that might not have been specifically covered above in my testimony.

Ms. Jacobson opines that Ameritech-IL's retail service representatives process only orders for services exclusive of data service. While it may be the case that the retail service representatives no longer process xDSL orders, they still process orders for ISDN, which has data functionality.

Ms. Schlackman describes situations wherein long loaded loops are reused for customers within 18,000 feet of the central office. She further states that the load coils that previously existed would cause no impairment to voice grade services. This attempt to justify the presence of load coils on loops less than 13,000 feet in length is flawed in several ways. Whenever OSP engineers are faced with reusing an existing copper cable in a route, the redeployment should be carefully studied to ascertain among other things, the engineering economics, the route balance, the commitment of spare pairs, and the interface hardware. As part of this analysis, the rearrangement of the plant would dictate the removal of the existing load coils. Moreover, contrary to Ms. Schlackman's statement, modem transmission used today over POTS lines can indeed be affected by the existence of load coils, as I discuss above.

As justification for the presence of bridged tap, Ms. Schlackman makes claim that it allows more flexibility and efficient use of cable pairs. While this may have been so prior to the concept of interfaced plant and party line service, bridged tap plant (multiple plant design) has been an obsolete design for several decades.

Further, Ms. Schlackman claims that Ameritech-IL does not normally perform loop conditioning in its own network. However, services such as ISDN have loop qualification requirements similar to various types of xDSL services. As such, it would seem counterintuitive to presume that Ameritech-IL has not conditioned its network to provide a service such as ISDN.

Finally, in her testimony, Ms. Schlackman opines that the work effort to provision and install the HFPL UNE carries the same or greater provisioning requirements as a stand-alone xDSL-capable loop. To the contrary, the addition of data to a pre-existing POTS line only involves the replacement of the jumper from the office equipment (switch) to the cable pair, with a jumper from and to a splitter. This work effort is far simpler than the provisioning of a totally new circuit to a customer premise.

Mr. Lube presents a treatise on the SBC deployment strategy for Project Pronto. While it certainly is the prerogative of SBC to design their "overlay" network in this fashion, it must be noted that SBC's design is not a unique solution, i.e., there are several ways of deploying a data network. Despite claims to the contrary, the solution proffered is not so integrated that individual parts cannot be used in an alternate fashion.

IX. TECHNICAL QUESTION PRESENTED BY THE COMMISSION

QUESTION #1:

What technical difficulties, if any, may be incurred by Ameritech in provisioning line sharing (or the high frequency portion of the loop network element) in areas where next generation digital loop carrier (or older generation DLC) is deployed?

A. There are several potential scenarios that will occur when end users are served via DLC. These include, but may not be limited to, fiber-fed DLCs of various vintages and copper driven DLCs of various vintages. Copper driven DLCs cannot be upgraded for xDSL services, and are therefore ineligible to serve as line share platforms. Of the fiber driven varieties of DLC, two basic assembly elements of those devices must be examined, i.e., the multiplexer that drives the fiber and the DLC equipment that interfaces with the multiplexer. Use of xDSL capable equipment involves use of an upgraded Next Generation Digital Loop Carrier ("NGDLC") that has xDSL capability, is SONET-based, and contains sufficient bandwidth either in its backplane or multiplexer. This arrangement will support "Plug and Play" options that can be delivered efficiently. The most likely design would permit end data users to be mapped to the serving central office's interoffice SONET multiplexer for delivery via ring topology to a "hub" office. At the hub office, Service Providers could receive the data stream at an ATM switch or gateway router, similar to those currently used by Internet Service Providers ("ISP's"). This configuration allows minimal collocation requirements by Service Providers, since any data traffic generated by an end user at the RT is groomed onto a Permanent Virtual Circuit ("PVC") entering the interoffice

SONET ring on one of the Service Provider's Permanent Virtual Paths ("PVPs") that brings the end user's data traffic to the ISP's ATM/Gateway router.

The next feasible alternative would require that end user data traffic be transported on the fiber pairs supporting the NGDLC electronics and multipler back to the serving central office, where the traffic would be separated, aggregated and routed to the proper ISP via some routing device such as SBC's Optical Concentration Device ("OCD"). Since the fiber cable facilities that drive the NGDLC are redundant, a measure of disaster recovery is maintained. A variant of this scheme calls for the data signal to travel on a separate fiber pair back to the office. While this is technically feasible, it could leave the data pipes vulnerable to catastrophic failure, due to lack of redundancy.

Options other than fiber fed upgraded NGDLC could be technically feasible, but are generally considered by the telecommunications industry to be impractical or uneconomic at this time.

QUESTION #2:

What would resolve the limitations, if any, imposed by # 1 above (i.e. sub-loop unbundling)? Please define all steps necessary to facilitate these solutions.

A. In the case of upgraded NGDLC that supports xDSL services, limitations revolve about issues that are chiefly legal and administrative in nature. From a technical perspective, CLECs require that copper facilities serving the end user (sub-loop) be "adapted" to line sharing via a plug-in card at the remote terminal. This plug-in card has both DSLAM and splitter functionality that allows the combined voice and data signal to be transported to the serving central office or to interoffice facilities for subsequent delivery to the CLEC's own environment.

Resolution of the issues of plug-in card ownership (ILEC owned and/or CLEC owned) and end-to-end provisioning schemes could deliver competitive advantages to Illinois consumers provided that a full menu of options is made available to CLECs. For example, ILEC owned and/or CLEC owned plug-in cards would permit a range of different services to be offered, as well as the potential for plug-in card cost benefits. Options relative to the delivery of end-to-end services would eliminate, in various scenarios, the requirements and costs associated with collocation. Moreover, it could, in very specific cases, eliminate or at least delay the requirement to install OCDs in some locations.

QUESTION #3:

What impediments, if any, exist that would make implementing the solutions described in # 2 above difficult? For example, assuming sub-loop unbundling could resolve some or all of the limitations, would Ameritech have the necessary space capacity in which to collocate DSLAM equipment to provision line sharing via sub-loop unbundling? Would Ameritech grant the competitive LECS the accessibility to their collocated DSLAM equipment needed to make sub-loop unbundling a viable solution?

A. Sub-loop unbundling combined with CLEC collocation of separate DSLAMS in or near the ILEC's remote terminals could, on the surface, provide a "technically feasible" solution – but one that would be impractical and uneconomical. It would be impractical from the point of view that space limitations, convoluted access proposals, and administrative entanglements would preclude efficient working arrangements. It would be uneconomical since potential "take rates" are far outweighed by the cost of access arrangements required at each RT site.

QUESTION #4:

Will interconnection requirements promote or deter line sharing via sub-loop unbundling (i.e., requiring the competitive LEC to interconnect at the remote terminal versus the serving area interface, or the competitive LEC being required to place transport facilities to the serving area interface)?

A. There would be numerous practical hurdles to be overcome (e.g., rights of way and easements, powering arrangements, environmental conditions, practicality of introducing additional cables into established, potentially congested hardware), coupled with administrative process problems (access, escort, coordination, etc.). Therefore, such arrangements might only be useful for line-sharing in very limited situations.

QUESTION #5:

Should pricing be established for sub-loop line sharing arrangements?

A. Yes. Pricing for subloop line sharing arrangements should be established to address for those specific circumstances in which it may offer a viable solution. Moreover, as the transition of CLECs into fiber-based provider arrangements occurs, subloop line sharing prices will be required.

QUESTION #6:

Does Ameritech-IL plan to offer "broadband service" (as provided by SBC to competitive LECs in Arkansas, Kansas, Missouri, Oklahoma, and Texas), or a comparrable service to competitive LECs in Illinois? If so, will this service be offered in addition to or in place of line sharing arrangements where DLC has been deployed?

A. Presumably Ameritech-IL will offer broadband service in a limited, very specific manner, thereby reducing the options and benefits that effective competition can bring to the residential consumers of Illinois.

82. Q. Have you reviewed the Ameritech tariff (ILL. C.C. No. 20) pertaining to unbundled network elements and number portability?

A. Yes. I have reviewed Part 19 (Unbundled Network Elements and Number Portability), Section 2 (Unbundled Loop and HPFL).

X. COMMENTS ON AMERITECH-IL'S LINE SHARING TARIFF

83. Q. Do you have any comments relative to this tariff offering?

A. Yes. The tariff as filed conflicts with the Commission's Arbitration Decision in Nos. 00-0312 and 00-0313 (consol.) (August 17, 2000) on several issues. Some of those elements are as follows:

- Company-owned Splitter, provided line at a time in the tariff (Part 19, Section 2, 1.6) should be provided line at a time, shelf at a time.
- Provisioning intervals (Part 19, Section 2, 2.3B) should be initially three business days, then two business days, and eventually one business day.

- Non intrusive testing only should be allowed with intrusive, MLT, tests allowed only with end user permission.
- Penalties associated with Forecasting should be eliminated.

84. Q. Are there other comments regarding the tariff filing that should be made?

A. Yes. There are a number of issues that should be addressed. These include but are not necessarily limited to the following:

- Technical Specifications (Part 19, Section 2, 2.1B). Bridged tap in excess of 2,500 feet in length should also carry a qualifier that no single bridged tap can exceed 2,000 feet in length.
- Technical specifications (Part 19, Section 2, 2.1B5). These rules should be applicable to all providers, ILECs and their affiliates inclusively.
- Maintenance (Part 19, Section 2, 2.2B5). The CLEC's providing their own splitters must be permitted to rearrange circuits contained therein, in order to maintain and upgrade their plant.
- Operational Support Systems: Loop Make Up Information (Part 19, Section 2, 2.5B1). When manual loop make-up information is required to be produced by Ameritech-Illinois because it failed to properly maintain its own database or chose to not follow its own guidelines/directions, this information should be provided at the cost associated with the production of this information via the mechanized OSS. Otherwise CLECs will be penalized and Ameritech will be rewarded for Ameritech's own inefficiencies.

85. Q. Does this conclude your testimony?

A. Yes, it does.